CLAIMS

Having thus described the aforementioned invention, we claim:

1.   A combined positron emission tomography (PET) and X-Ray computerized tomography (CT) tomograph for acquiring PET and CT images with a known geometric relationship between pixels of said images, said combined PET and X-Ray CT tomograph comprising:

a CT scanner having a patient gantry, said CT scanner including a plurality of detectors, said CT scanner being provided for acquiring a CT image;

a PET scanner having a patient gantry separate from said CT scanner patient gantry, said PET scanner including a plurality of detectors, said PET scanner being provided for acquiring a PET image;

a patient support for supporting a patient positioned within each of said CT scanner patient gantry and said PET scanner patient gantry, said patient support being movable axially within each of said CT scanner patient gantry and said PET scanner patient gantry; and

a display device for displaying at least one of said CT image, said PET image and a fused PET/CT image generated by said combined PET and X-Ray CT tomograph.

2.   The combined PET and X-Ray CT tomograph of Claim 1 wherein said CT scanner patient gantry is fixed relative to said PET scanner patient gantry, said patient support being movable between said CT scanner patient gantry and said PET scanner patient gantry.

3.   The combined PET and X-Ray CT tomograph of Claim 1 wherein at least one of said CT scanner patient gantry and said PET scanner patient gantry is movable with respect the other, and wherein said patient support is movable between said CT scanner patient gantry and said PET scanner patient gantry.

4.   A combined positron emission tomography (PET) and X-Ray computerized tomography (CT) tomograph for acquiring PET and CT images with a

3 known geometric relationship between pixels of said images, said combined PET

4 and X-Ray CT tomograph comprising:

5   a CT scanner having a patient gantry, said CT scanner including a plurality

6 of detectors, said CT scanner being provided for acquiring a CT image;

7   a PET scanner having a patient gantry separate from said CT scanner

8 patient gantry, said PET scanner including a plurality of detectors, said PET

9 scanner being provided for acquiring a PET image;

10   a patient support for supporting a patient positioned within each of said CT

11 scanner patient gantry and said PET scanner patient gantry, said patient support

12 being movable axially within each of said CT scanner patient gantry and said PET

13 scanner patient gantry;

14   a processor for reconstructing said CT image to achieve a reconstructed CT

15 image, for reconstructing said PET image to achieve a reconstructed PET image,

16 and for generating a fused PET/CT image; and

17   a display device for displaying at least one of said reconstructed CT image,

18 said reconstructed PET image and said fused PET/CT image.

1   5.   The combined PET and X-Ray CT tomograph of Claim 4 wherein said

2 CT scanner patient gantry is fixed relative to said PET scanner patient gantry, said

3 patient support being movable between said CT scanner patient gantry and said

4 PET scanner patient gantry.

1   6.   The combined PET and X-Ray CT tomograph of Claim 4 wherein at

2 least one of said CT scanner patient gantry and said PET scanner patient gantry is

3 movable with respect the other, and wherein said patient support is movable

4 between said CT scanner patient gantry and said PET scanner patient gantry.

1   7.   A combined positron emission tomography (PET) and X-Ray

2 computerized tomography (CT) tomograph for acquiring PET and CT images with a

3 known geometric relationship between pixels of said images, said combined PET

4 and X-Ray CT tomograph comprising:

5   a CT scanner having a patient gantry, said CT scanner including a plurality

6 of detectors, said CT scanner being provided for acquiring a CT image;

7   a PET scanner having a patient gantry separate from said CT scanner

8 patient gantry, said PET scanner including a plurality of detectors, said PET

9 scanner being provided for acquiring a PET image;

10   a patient support for supporting a patient positioned within each of said CT

11 scanner patient gantry and said PET scanner patient gantry, said patient support

12 being movable axially within each of said CT scanner patient gantry and said PET

13 scanner patient gantry;

14   a processor for reconstructing said CT image to achieve a reconstructed CT

15 image, for reconstructing said PET image to achieve a reconstructed PET image, for

16 correcting said reconstructed PET image to achieve a corrected PET image, and for

17 generating a fused PET/CT image; and

18   a display device for displaying at least one of said reconstructed CT image,

19 said corrected PET image and said fused PET/CT image.

1   8.   The combined PET and X-Ray CT tomograph of Claim 7 wherein said

2 CT scanner patient gantry is fixed relative to said PET scanner patient gantry, said

3 patient support being movable between said CT scanner patient gantry and said

4 PET scanner patient gantry.

1   9.   The combined PET and X-Ray CT tomograph of Claim 7 wherein at

2 least one of said CT scanner patient gantry and said PET scanner patient gantry is

3 movable with respect the other, and wherein said patient support is movable

4 between said CT scanner patient gantry and said PET scanner patient gantry.

1   10.   A combined positron emission tomography (PET) and X-Ray

2 computerized tomography (CT) tomograph for acquiring PET and CT images with a

3 known geometric relationship between pixels of said images, said combined PET

4 and X-Ray CT tomograph comprising:

5   a CT scanner having a patient gantry, said CT scanner including a plurality

6 of detectors, said CT scanner being provided for acquiring a CT image;

7   a PET scanner having a patient gantry separate from said CT scanner

8 patient gantry, said PET scanner including a plurality of detectors, said PET

9 scanner being provided for acquiring a PET image;

10   a patient support for supporting a patient positioned within each of said CT

11   scanner patient gantry and said PET scanner patient gantry, said patient support

12   being movable axially within each of said CT scanner patient gantry and said PET

13   scanner patient gantry;

14   a processor for reconstructing said CT image to achieve a reconstructed CT

15   image, for reconstructing said PET image to achieve a reconstructed PET image, for

16   correcting said reconstructed PET image to achieve a corrected PET image, for

17   generating attenuation correction factors from said reconstructed CT image, and

18   for generating a fused PET/CT image; and

19   a display device for displaying at least one of said reconstructed CT image,

20   said corrected PET image and said fused PET/CT image.

1   11.   The combined PET and X-Ray CT tomograph of Claim 10 wherein said

2   CT scanner patient gantry is fixed relative to said PET scanner patient gantry, said

3   patient support being movable between said CT scanner patient gantry and said

4   PET scanner patient gantry.

1   12.   The combined PET and X-Ray CT tomograph of Claim 10 wherein at

2   least one of said CT scanner patient gantry and said PET scanner patient gantry is

3   movable with respect the other, and wherein said patient support is movable

4   between said CT scanner patient gantry and said PET scanner patient gantry.

1   13.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT scanner having a patient gantry, said CT scanner including a plurality

6   of detectors, said CT scanner being provided for acquiring a CT image;

7   a PET scanner having a patient gantry separate from said CT scanner

8   patient gantry, said PET scanner including a plurality of detectors, said PET

9   scanner being provided for acquiring a PET image;

10   a patient support for supporting a patient positioned within each of said CT

11   scanner patient gantry and said PET scanner patient gantry, said patient support

12   being movable axially within each of said CT scanner patient gantry and said PET

13   scanner patient gantry;

14   a processor for reconstructing said CT image to achieve a reconstructed CT

15   image, for reconstructing said PET image to achieve a reconstructed PET image, for

16   correcting said reconstructed PET image to achieve a corrected PET image, for

17   generating attenuation correction factors from said reconstructed CT image, for

18   applying said attenuation correction factors to said corrected PET image to achieve

19   an attenuation-corrected PET image, and for generating a fused PET/CT image;

20   and

21   a display device for displaying at least one of said reconstructed CT image,

22   said attenuation-corrected PET image and said fused PET/CT image.

1   14.   The combined PET and X-Ray CT tomograph of Claim 13 wherein said

2   CT scanner patient gantry is fixed relative to said PET scanner patient gantry, said

3   patient support being movable between said CT scanner patient gantry and said

4   PET scanner patient gantry.

1   15.   The combined PET and X-Ray CT tomograph of Claim 13 wherein at

2   least one of said CT scanner patient gantry and said PET scanner patient gantry is

3   movable with respect the other, and wherein said patient support is movable

4   between said CT scanner patient gantry and said PET scanner patient gantry.

1   16.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT scanner having a patient gantry, said CT scanner including a plurality

6   of detectors, said CT scanner being provided for acquiring a CT image;

7   a PET scanner having a patient gantry separate from said CT scanner

8   patient gantry, said PET scanner including a plurality of detectors, said PET

9   scanner being provided for acquiring a PET image;

10   a patient support for supporting a patient positioned within each of said CT

11   scanner patient gantry and said PET scanner patient gantry, said patient support

12   being movable axially within each of said CT scanner patient gantry and said PET

13   scanner patient gantry;

14   a processor for correcting said CT image for artifacts due to field of view

15   truncation, for reconstructing said CT image to achieve a reconstructed CT image,

16   for reconstructing said PET image to achieve a reconstructed PET image, and for

17   generating a fused PET/CT image; and

18   a display device for displaying at least one of said reconstructed CT image,

19   said reconstructed PET image and said fused PET/CT image.

1   17.   The combined PET and X-Ray CT tomograph of Claim 16 wherein said

2   CT scanner patient gantry is fixed relative to said PET scanner patient gantry, said

3   patient support being movable between said CT scanner patient gantry and said

4   PET scanner patient gantry.

1   18.   The combined PET and X-Ray CT tomograph of Claim 16 wherein at

2   least one of said CT scanner patient gantry and said PET scanner patient gantry is

3   movable with respect the other, and wherein said patient support is movable

4   between said CT scanner patient gantry and said PET scanner patient gantry.

1   19.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT scanner including a plurality of detectors, said CT scanner being

6   provided for acquiring a CT image;

7   a PET scanner including a plurality of detectors, said PET scanner being

8   provided for acquiring a PET image, said PET scanner plurality of detectors being

9   mounted in fixed relationship to said CT scanner plurality of detectors;

10   a patient gantry for use with both said CT scanner and said PET scanner;

11   a patient support for supporting a patient positioned within said patient

12   gantry, said patient support being movable axially within said patient gantry; and

13   a display device for displaying at least one of a reconstructed CT image, a

14   reconstructed PET image and a fused PET/CT image generated by said combined

15   PET and X-Ray CT tomograph.

1   20.   A combined positron emission tomography (PET) and X-Ray
2 computerized tomography (CT) tomograph for acquiring PET and CT images with a
3 known geometric relationship between pixels of said images, said combined PET
4 and X-Ray CT tomograph comprising:
5   a CT scanner including a plurality of detectors, said CT scanner being
6 provided for acquiring a CT image;
7   a PET scanner including a plurality of detectors, said PET scanner being
8 provided for acquiring a PET image, said PET scanner plurality of detectors being
9 mounted in fixed relationship to said CT scanner plurality of detectors;
10   a patient gantry for use with both said CT scanner and said PET scanner;
11   a patient support for supporting a patient positioned within said patient
12 gantry, said patient support being movable axially within said patient gantry;
13   a processor for reconstructing said CT image to achieve a reconstructed CT
14 image, for reconstructing said PET image to achieve a reconstructed PET image,
15 and for generating a fused PET/CT image; and
16   a display device for displaying at least one of said reconstructed CT image,
17 said reconstructed PET image and said fused PET/CT image.

1   21.   A combined positron emission tomography (PET) and X-Ray
2 computerized tomography (CT) tomograph for acquiring PET and CT images with a
3 known geometric relationship between pixels of said images, said combined PET
4 and X-Ray CT tomograph comprising:
5   a CT scanner including a plurality of detectors, said CT scanner being
6 provided for acquiring a CT image;
7   a PET scanner including a plurality of detectors, said PET scanner being
8 provided for acquiring a PET image, said PET scanner plurality of detectors being
9 mounted in fixed relationship to said CT scanner plurality of detectors;
10   a patient gantry for use with both said CT scanner and said PET scanner;
11   a patient support for supporting a patient positioned within said patient
12 gantry, said patient support being movable axially within said patient gantry;
13   a processor for reconstructing said CT image to achieve a reconstructed CT
14 image, for reconstructing said PET image to achieve a reconstructed PET image, for

15 correcting said reconstructed PET image to achieve a corrected PET image, and for

16 generating a fused PET/CT image; and

17   a display device for displaying at least one of said reconstructed CT image,

18 said corrected PET image and said fused PET/CT image.

1   22.   A combined positron emission tomography (PET) and X-Ray

2 computerized tomography (CT) tomograph for acquiring PET and CT images with a

3 known geometric relationship between pixels of said images, said combined PET

4 and X-Ray CT tomograph comprising:

5   a CT scanner including a plurality of detectors, said CT scanner being

6 provided for acquiring a CT image;

7   a PET scanner including a plurality of detectors, said PET scanner being

8 provided for acquiring a PET image, said PET scanner plurality of detectors being

9 mounted in fixed relationship to said CT scanner plurality of detectors;

10   a patient gantry for use with both said CT scanner and said PET scanner;

11   a patient support for supporting a patient positioned within said patient

12 gantry, said patient support being movable axially within said patient gantry;

13   a processor for reconstructing said CT image to achieve a reconstructed CT

14 image, for reconstructing said PET image to achieve a reconstructed PET image, for

15 correcting said reconstructed PET image to achieve a corrected PET image, for

16 generating attenuation correction factors from said reconstructed CT image, and

17 for generating a fused PET/CT image; and

18   a display device for displaying at least one of said reconstructed CT image,

19 said corrected PET image and said fused PET/CT image.

1   23.   A combined positron emission tomography (PET) and X-Ray

2 computerized tomography (CT) tomograph for acquiring PET and CT images with a

3 known geometric relationship between pixels of said images, said combined PET

4 and X-Ray CT tomograph comprising:

5   a CT scanner including a plurality of detectors, said CT scanner being

6 provided for acquiring a CT image;

7   a PET scanner including a plurality of detectors, said PET scanner being

8   provided for acquiring a PET image, said PET scanner plurality of detectors being

9   mounted in fixed relationship to said CT scanner plurality of detectors;

10   a patient gantry for use with both said CT scanner and said PET scanner;

11   a patient support for supporting a patient positioned within said patient

12   gantry, said patient support being movable axially within said patient gantry;

13   a processor for reconstructing said CT image to achieve a reconstructed CT

14   image, for reconstructing said PET image to achieve a reconstructed PET image, for

15   correcting said reconstructed PET image to achieve a corrected PET image, for

16   generating attenuation correction factors from said reconstructed CT image, for

17   applying said attenuation correction factors to said corrected PET image to achieve

18   an attenuation-corrected PET image, and for generating a fused PET/CT image;

19   and

20   a display device for displaying at least one of said reconstructed CT image,

21   said attenuation-corrected PET image and said fused PET/CT image.

1   24.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT scanner including a plurality of detectors, said CT scanner being

6   provided for acquiring a CT image;

7   a PET scanner including a plurality of detectors, said PET scanner being

8   provided for acquiring a PET image, said PET scanner plurality of detectors being

9   mounted in fixed relationship to said CT scanner plurality of detectors;

10   a patient gantry for use with both said CT scanner and said PET scanner;

11   a patient support for supporting a patient positioned within said patient

12   gantry, said patient support being movable axially within said patient gantry;

13   a processor for correcting said CT image for artifacts due to field of view

14   truncation, for reconstructing said CT image to achieve a reconstructed CT image,

15   for reconstructing said PET image to achieve a reconstructed PET image, and for

16   generating a fused PET/CT image; and

17   a display device for displaying at least one of said reconstructed CT image,

18   said reconstructed PET image and said fused PET/CT image.

1   25.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means having a

6   patient gantry and including a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   having a patient gantry separate from said CT image means patient gantry, said

9   PET image means including a plurality of detectors;

10   a patient support means for supporting a patient positioned within each of

11   said CT image means patient gantry and said PET image means patient gantry,

12   said patient support means being movable axially within each of said CT image

13   means patient gantry and said PET image means patient gantry; and

14   a display means for displaying at least one of said CT image, said PET image

15   and a fused PET/CT image generated by said combined PET and X-Ray CT

16   tomograph.

1   26.   The combined PET and X-Ray CT tomograph of Claim 25 wherein said

2   CT image means patient gantry is fixed relative to said PET image means patient

3   gantry, said patient support means being movable between said CT image means

4   patient gantry and said PET image means patient gantry.

1   27.   The combined PET and X-Ray CT tomograph of Claim 25 wherein at

2   least one of said CT image means patient gantry and said PET image means patient

3   gantry is movable with respect the other, and wherein said patient support means

4   is movable between said CT image means patient gantry and said PET image

5   means patient gantry.

1   28.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means having a

6   patient gantry and including a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   having a patient gantry separate from said CT image means patient gantry, said

9   PET image means including a plurality of detectors;

10   a patient support means for supporting a patient positioned within each of

11   said CT image means patient gantry and said PET image means patient gantry,

12   said patient support means being movable axially within each of said CT image

13   means patient gantry and said PET image means patient gantry;

14   a processor means for reconstructing said CT image to achieve a

15   reconstructed CT image, for reconstructing said PET image to achieve a

16   reconstructed PET image, and for generating a fused PET/CT image; and

17   a display means for displaying at least one of said CT image, said PET image

18   and said fused PET/CT image.

1   29.   The combined PET and X-Ray CT tomograph of Claim 28 wherein said

2   CT image means patient gantry is fixed relative to said PET image means patient

3   gantry, said patient support means being movable between said CT image means

4   patient gantry and said PET image means patient gantry.

1   30.   The combined PET and X-Ray CT tomograph of Claim 28

2   wherein at least one of said CT image means patient gantry and said PET

3   image means patient gantry is movable with respect the other, and wherein

4   said patient support means is movable between said CT image means

5   patient gantry and said PET image means patient gantry.

1   31.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means having a

6   patient gantry and including a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   having a patient gantry separate from said CT image means patient gantry, said

9   PET image means including a plurality of detectors;

10   a patient support means for supporting a patient positioned within each of

11   said CT image means patient gantry and said PET image means patient gantry,

12   said patient support means being movable axially within each of said CT image

13   means patient gantry and said PET image means patient gantry;

14   a processor means for reconstructing said CT image to achieve a

15   reconstructed CT image, for reconstructing said PET image to achieve a

16   reconstructed PET image, for correcting said reconstructed PET image to achieve a

17   corrected PET image, and for generating a fused PET/CT image; and

18   a display means for displaying at least one of said reconstructed CT image,

19   said corrected PET image and said fused PET/CT image.

1   32.   The combined PET and X-Ray CT tomograph of Claim 31 wherein said

2   CT image means patient gantry is fixed relative to said PET image means patient

3   gantry, said patient support means being movable between said CT image means

4   patient gantry and said PET image means patient gantry.

1   33.   The combined PET and X-Ray CT tomograph of Claim 31 wherein at

2   least one of said CT image means patient gantry and said PET image means patient

3   gantry is movable with respect the other, and wherein said patient support means

4   is movable between said CT image means patient gantry and said PET image

5   means patient gantry.

1   34.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means having a

6   patient gantry and including a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   having a patient gantry separate from said CT image means patient gantry, said

9   PET image means including a plurality of detectors;

10   a patient support means for supporting a patient positioned within each of

11   said CT image means patient gantry and said PET image means patient gantry,

12   said patient support means being movable axially within each of said CT image

13   means patient gantry and said PET image means patient gantry;

14   a processor means for reconstructing said CT image to achieve a

15   reconstructed CT image, for reconstructing said PET image to achieve a

16   reconstructed PET image, for correcting said reconstructed PET image to achieve a

17   corrected PET image, for generating attenuation correction factors from said

18   reconstructed CT image, and for generating a fused PET/CT image; and

19   a display means for displaying at least one of said reconstructed CT image,

20   said corrected PET image and said fused PET/CT image.

1   35.   The combined PET and X-Ray CT tomograph of Claim 34 wherein said

2   CT image means patient gantry is fixed relative to said PET image means patient

3   gantry, said patient support means being movable between said CT image means

4   patient gantry and said PET image means patient gantry.

1   36.   The combined PET and X-Ray CT tomograph of Claim 34 wherein at

2   least one of said CT image means patient gantry and said PET image means patient

3   gantry is movable with respect the other, and wherein said patient support means

4   is movable between said CT image means patient gantry and said PET image

5   means patient gantry.

1   37.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means having a

6   patient gantry and including a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   having a patient gantry separate from said CT image means patient gantry, said

9   PET image means including a plurality of detectors;

10   a patient support means for supporting a patient positioned within each of

11   said CT image means patient gantry and said PET image means patient gantry,

12   said patient support means being movable axially within each of said CT image

13   means patient gantry and said PET image means patient gantry;

14   a processor means for reconstructing said CT image to achieve a

15   reconstructed CT image, for reconstructing said PET image to achieve a

16   reconstructed PET image, for correcting said reconstructed PET image to achieve a

17   corrected PET image, for generating attenuation correction factors from said

18   reconstructed CT image, for applying said attenuation correction factors to said

19   corrected PET image to achieve an attenuation-corrected PET image, and for

20   generating a fused PET/CT image; and

21   a display means for displaying at least one of said reconstructed CT image,

22   said attenuation-corrected PET image and said fused PET/CT image.

1   38.   The combined PET and X-Ray CT tomograph of Claim 37 wherein said

2   CT image means patient gantry is fixed relative to said PET image means patient

3   gantry, said patient support means being movable between said CT image means

4   patient gantry and said PET image means patient gantry.

1   39.   The combined PET and X-Ray CT tomograph of Claim 37 wherein at

2   least one of said CT image means patient gantry and said PET image means patient

3   gantry is movable with respect the other, and wherein said patient support means

4   is movable between said CT image means patient gantry and said PET image

5   means patient gantry.

1   40.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means having a

6   patient gantry and including a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   having a patient gantry separate from said CT image means patient gantry, said

9   PET image means including a plurality of detectors;

10   a patient support means for supporting a patient positioned within each of

11   said CT image means patient gantry and said PET image means patient gantry,

12   said patient support means being movable axially within each of said CT image

13   means patient gantry and said PET image means patient gantry;

14   a processor means for correcting said CT image for artifacts due to field of

15   view truncation, for reconstructing said CT image to achieve a reconstructed CT

16   image, for reconstructing said PET image to achieve a reconstructed PET image,

17   and for generating a fused PET/CT image; and

18   a display means for displaying at least one of said reconstructed CT image,

19   said reconstructed PET image and said fused PET/CT image.

1   41.   The combined PET and X-Ray CT tomograph of Claim 40 wherein said

2   CT image means patient gantry is fixed relative to said PET image means patient

3   gantry, said patient support means being movable between said CT image means

4   patient gantry and said PET image means patient gantry.

1   42.   The combined PET and X-Ray CT tomograph of Claim 40 wherein at

2   least one of said CT image means patient gantry and said PET image means patient

3   gantry is movable with respect the other, and wherein said patient support means

4   is movable between said CT image means patient gantry and said PET image

5   means patient gantry.

1   43.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means including

6   a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   including a plurality of detectors mounted on in fixed relationship to said CT image

9   means plurality of detectors;

10   a patient gantry means for use with both said CT image means and said PET

11   image means;

12   a patient support means for supporting a patient positioned within said

13   patient gantry means, said patient support means being movable axially within

14   said patient gantry means; and

15   a display means for displaying at least one of a reconstructed CT image, a

16   reconstructed PET image and a fused PET/CT image generated by said combined

17   PET and X-Ray CT tomograph.

1   44.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means including

6   a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   including a plurality of detectors mounted on in fixed relationship to said CT image

9   means plurality of detectors;

10   a patient gantry means for use with both said CT image means and said PET

11   image means;

12   a patient support means for supporting a patient positioned within said

13   patient gantry means, said patient support means being movable axially within

14   said patient gantry means;

15   a processor means for reconstructing said CT image to achieve a

16   reconstructed CT image, for reconstructing said PET image to achieve a

17   reconstructed PET image, and for generating a fused PET/CT image; and

18   a display means for displaying at least one of said reconstructed CT image,

19   said reconstructed PET image and said fused PET/CT image.

1   45.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means including

6   a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   including a plurality of detectors mounted on in fixed relationship to said CT image

9   means plurality of detectors;

10   a patient gantry means for use with both said CT image means and said PET

11   image means;

12   a patient support means for supporting a patient positioned within said

13   patient gantry means, said patient support means being movable axially within

14   said patient gantry means;

15   a processor means for reconstructing said CT image to achieve a

16   reconstructed CT image, for reconstructing said PET image to achieve a

17   reconstructed PET image, for correcting said reconstructed PET image to achieve a

18   corrected PET image, and for generating a fused PET/CT image; and

19   a display means for displaying at least one of said reconstructed CT image,

20   said corrected PET image and said fused PET/CT image.

1   46.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means including

6   a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   including a plurality of detectors mounted on in fixed relationship to said CT image

9   means plurality of detectors;

10   a patient gantry means for use with both said CT image means and said PET

11   image means;

12   a patient support means for supporting a patient positioned within said

13   patient gantry means, said patient support means being movable axially within

14   said patient gantry means;

15   a processor means for reconstructing said CT image to achieve a

16   reconstructed CT image, for reconstructing said PET image to achieve a

17   reconstructed PET image, for correcting said reconstructed PET image to achieve a

18   corrected PET image, for generating attenuation correction factors from said

19   reconstructed CT image, and for generating a fused PET/CT image; and

20   a display means for displaying at least one of said reconstructed CT image,

21   said corrected PET image and said fused PET/CT image.

1   47.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means including

6   a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   including a plurality of detectors mounted on in fixed relationship to said CT image

9   means plurality of detectors;

10   a patient gantry means for use with both said CT image means and said PET

11   image means;

12   a patient support means for supporting a patient positioned within said

13   patient gantry means, said patient support means being movable axially within

14   said patient gantry means;

15   a processor means for reconstructing said CT image to achieve a

16   reconstructed CT image, for reconstructing said PET image to achieve a

17   reconstructed PET image, for correcting said reconstructed PET image to achieve a

18   corrected PET image, for generating attenuation correction factors from said

19   reconstructed CT image, for applying said attenuation correction factors to said

20   corrected PET image to achieve an attenuation-corrected PET image, and for

21   generating a fused PET/CT image; and

22   a display means for displaying at least one of said reconstructed CT image,

23   said attenuation-corrected PET image and said fused PET/CT image.

1   48.   A combined positron emission tomography (PET) and X-Ray

2   computerized tomography (CT) tomograph for acquiring PET and CT images with a

3   known geometric relationship between pixels of said images, said combined PET

4   and X-Ray CT tomograph comprising:

5   a CT image means for acquiring a CT image, said CT image means including

6   a plurality of detectors;

7   a PET image means for acquiring a PET image, said PET image means

8   including a plurality of detectors mounted on in fixed relationship to said CT image

9   means plurality of detectors;

10   a patient gantry means for use with both said CT image means and said PET

11   image means;

12   a patient support means for supporting a patient positioned within said

13   patient gantry means, said patient support means being movable axially within

14   said patient gantry means;

15   a processor means for correcting said CT image for artifacts due to field of

16   view truncation, for reconstructing said CT image to achieve a reconstructed CT

17   image, for reconstructing said PET image to achieve a reconstructed PET image,

18   and for generating a fused PET/CT image; and

19   a display means for displaying at least one of said reconstructed CT image,

20   said attenuation-corrected PET image and said fused PET/CT image.

1   49.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   CT scanner having a patient gantry, a PET scanner having a patient gantry, a

4   patient support for supporting a patient positioned within each of said CT scanner

5   patient gantry and said PET scanner patient gantry, and a display device, said

6   method comprising the steps of:

7   introducing a tracer into a patient for detection by said combined PET and

8   X-Ray CT tomograph;

9   waiting for an uptake period to expire, the tracer being circulated through

10   and absorbed by the patient during said uptake period;

11   placing the patient on said patient support;

12   moving said patient support to position the patient within said CT scanner

13   patient gantry such that a selected region to be studied is within a field of view of

14   said CT scanner;

15   acquiring a CT image of the selected region of the patient;

16   moving said patient support to position the patient within said PET scanner

17   patient gantry such that the selected region to be studied is within a field of view of

18   said PET scanner;

19   acquiring a PET image of the selected region of the patient; and

20   reconstructing said PET image to achieve a reconstructed PET image.

1   50.   The method of Claim 49, during said step of acquiring a PET image of

2   the selected region of the patient, further comprising the step of continuously

3   moving said patient support in an axial direction within said patient gantry,

4   whereby normalization effects between individual detector rings of said PET

5   scanner are eliminated.

1   51.   The method of Claim 49 wherein said CT scanner patient gantry is

2   separate from and fixed relative to said PET scanner patient gantry, said patient

3   support being movable between said CT scanner patient gantry and said PET

4   scanner patient gantry, whereby said step of acquiring a CT image of the selected

5   region of the patient is accomplished within said CT scanner patient gantry, and

6   whereby said step of acquiring a PET image of the selected region of the patient is

7   accomplished within said PET scanner patient gantry.

1   52.   The method of Claim 49 wherein said CT scanner patient gantry is

2   separate from said PET scanner patient gantry, wherein at least one of said CT

3   scanner and said PET scanner is movable with respect the other, and wherein said

4   patient support is movable between said CT scanner patient gantry and said PET

5   scanner patient gantry, whereby said step of acquiring a CT image of the selected

6   region of the patient is accomplished within said CT scanner patient gantry, and

7   whereby said step of acquiring a PET image of the selected region of the patient is

8   accomplished within said PET scanner patient gantry.

1   53.   The method of Claim 52 wherein said step of moving said patient

2   support to position the patient within said CT scanner patient gantry is

3   accomplished by moving said CT scanner to receive said patient bed within said CT

4   scanner patient gantry.

1   54.   The method of Claim 52 wherein said step of moving said patient

2   support to position the patient within said PET scanner patient gantry is

3   accomplished by moving said PET scanner to receive said patient bed within said

4   PET scanner patient gantry.

1   55.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   CT scanner having a patient gantry, a PET scanner having a patient gantry, a

4   patient support for supporting a patient positioned within each of said CT scanner

5   patient gantry and said PET scanner patient gantry, and a display device, said

6   method comprising the steps of:

7   introducing a tracer into a patient for detection by said combined PET and

8   X-Ray CT tomograph;

9   waiting for an uptake period to expire, the tracer being circulated through

10   and absorbed by the patient during said uptake period;

11   placing the patient on said patient support;

12   moving said patient support to position the patient within said CT scanner

13   patient gantry such that a selected region to be studied is within a field of view of

14   said CT scanner;

15   acquiring a CT image of the selected region of the patient;

16   reconstructing said CT image to achieve a reconstructed CT image;

17   moving said patient support to position the patient within said PET scanner

18   patient gantry such that the selected region to be studied is within a field of view of

19   said PET scanner;

20   acquiring a PET image of the selected region of the patient; and

21   reconstructing said PET image to achieve a reconstructed PET image.

1   56.   The method of Claim 55, after said step of acquiring a CT image and

2   before said step of reconstructing said CT image, further comprising the step of

3   correcting said CT image for artifacts due to field of view truncation.

1   57.   The method of Claim 56 wherein said step of correcting said CT image

2   includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image

4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the

6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the

8   selected region using an average linear attenuation coefficient for the truncated

9   portion of the selected region; and

10   adding said volume to said CT image.

1   58.   The method of Claim 55 further including the step of displaying at

2   least one of said reconstructed CT image and said reconstructed PET image.

1   59.   The method of Claim 55 further including the step of fusing said

2   reconstructed CT image and said reconstructed PET image to achieve a fused

3   PET/CT image.

1   60.   The method of Claim 55, during said step of acquiring a PET image of

2   the selected region of the patient, further comprising the step of continuously

3   moving said patient support in an axial direction within said patient gantry,

4   whereby normalization effects between individual detector rings of said PET

5   scanner are eliminated.

1   61.   The method of Claim 55 wherein said CT scanner patient gantry is

2   separate from and fixed relative to said PET scanner patient gantry, said patient

3   support being movable between said CT scanner patient gantry and said PET

4   scanner patient gantry, whereby said step of acquiring a CT image of the selected

5   region of the patient is accomplished within said CT scanner patient gantry, and

6   whereby said step of acquiring a PET image of the selected region of the patient is

7   accomplished within said PET scanner patient gantry.

1   62.   The method of Claim 55 wherein said CT scanner patient gantry is

2   separate from said PET scanner patient gantry, wherein at least one of said CT

3   scanner and said PET scanner is movable with respect the other, and wherein said

4   patient support is movable between said CT scanner patient gantry and said PET

5   scanner patient gantry, whereby said step of acquiring a CT image of the selected

6   region of the patient is accomplished within said CT scanner patient gantry, and

7   whereby said step of acquiring a PET image of the selected region of the patient is

8   accomplished within said PET scanner patient gantry.

1   63.   The method of Claim 62 wherein said step of moving said patient

2   support to position the patient within said CT scanner patient gantry is

3   accomplished by moving said CT scanner to receive said patient bed within said CT

4   scanner patient gantry.

1   64.   The method of Claim 62 wherein said step of moving said patient

2   support to position the patient within said PET scanner patient gantry is

3   accomplished by moving said PET scanner to receive said patient bed within said

4   PET scanner patient gantry.

1   65.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   CT scanner having a patient gantry, a PET scanner having a patient gantry, a

4   patient support for supporting a patient positioned within each of said CT scanner

5   patient gantry and said PET scanner patient gantry, and a display device, said

6   method comprising the steps of:

7   introducing a tracer into a patient for detection by said combined PET and

8   X-Ray CT tomograph;

9   waiting for an uptake period to expire, the tracer being circulated through

10   and absorbed by the patient during said uptake period;

11   placing the patient on said patient support;

12   moving said patient support to position the patient within said CT scanner

13   patient gantry such that a selected region to be studied is within a field of view of

14   said CT scanner;

15   acquiring a CT image of the selected region of the patient;

16   reconstructing said CT image to achieve a reconstructed CT image;

17   generating attenuation correction factors from said reconstructed CT image;

18   moving said patient support to position the patient within said PET scanner
19 patient gantry such that the selected region to be studied is within a field of view of
20 said PET scanner;
21   acquiring a PET image of the selected region of the patient; and
22   reconstructing said PET image to achieve a reconstructed PET image.

1   66.   The method of Claim 65, after said step of acquiring a CT image and
2 before said step of reconstructing said CT image, further comprising the step of
3 correcting said CT image for artifacts due to field of view truncation.

1   67.   The method of Claim 66 wherein said step of correcting said CT image
2 includes the steps of:
3   obtaining a non-corrected PET image, said non-corrected PET image
4 reconstructed without attenuation correction;
5   determining a boundary of a truncated portion of the selected region of the
6 patient using said non-corrected PET image;
7   estimating a volume within said boundary of the truncated portion of the
8 selected region using an average linear attenuation coefficient for the truncated
9 portion of the selected region; and
10   adding said volume to said CT image.

1   68.   The method of Claim 65 wherein said step of generating attenuation
2 correction factors from said reconstructed CT image is performed using the steps
3 of:
4   estimating an attenuation image at 511 keV using a threshold to separate
5 out a bone component of said reconstructed CT image; and
6   scaling said bone component using a first scaling factor and a non-bone
7 component of said reconstructed CT image using a second scaling factor.

1   69.   The method of Claim 65 further including the step of displaying at
2 least one of said reconstructed CT image and said reconstructed PET image.

1   70.   The method of Claim 65 further including the step of fusing said
2   reconstructed CT image and said reconstructed PET image to achieve a fused
3   PET/CT image.

1   71.   The method of Claim 65, during said step of acquiring a PET image of
2   the selected region of the patient, further comprising the step of continuously
3   moving said patient support in an axial direction within said patient gantry,
4   whereby normalization effects between individual detector rings of said PET
5   scanner are eliminated.

1   72.   The method of Claim 65 wherein said CT scanner patient gantry is
2   separate from and fixed relative to said PET scanner patient gantry, said patient
3   support being movable between said CT scanner patient gantry and said PET
4   scanner patient gantry, whereby said step of acquiring a CT image of the selected
5   region of the patient is accomplished within said CT scanner patient gantry, and
6   whereby said step of acquiring a PET image of the selected region of the patient is
7   accomplished within said PET scanner patient gantry.

1   73.   The method of Claim 65 wherein said CT scanner patient gantry is
2   separate from said PET scanner patient gantry, wherein at least one of said CT
3   scanner and said PET scanner is movable with respect the other, and wherein said
4   patient support is movable between said CT scanner patient gantry and said PET
5   scanner patient gantry, whereby said step of acquiring a CT image of the selected
6   region of the patient is accomplished within said CT scanner patient gantry, and
7   whereby said step of acquiring a PET image of the selected region of the patient is
8   accomplished within said PET scanner patient gantry.

1   74.   The method of Claim 73 wherein said step of moving said patient
2   support to position the patient within said CT scanner patient gantry is
3   accomplished by moving said CT scanner to receive said patient bed within said CT
4   scanner patient gantry.

1   75.   The method of Claim 73 wherein said step of moving said patient
2   support to position the patient within said PET scanner patient gantry is

3 accomplished by moving said PET scanner to receive said patient bed within said
4 PET scanner patient gantry.

1   76.   A method for acquiring PET and CT images within a combined PET
2 and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a
3 CT scanner having a patient gantry, a PET scanner having a patient gantry, a
4 patient support for supporting a patient positioned within each of said CT scanner
5 patient gantry and said PET scanner patient gantry, and a display device, said
6 method comprising the steps of:
7   introducing a tracer into a patient for detection by said combined PET and
8 X-Ray CT tomograph;
9   waiting for an uptake period to expire, the tracer being circulated through
10 and absorbed by the patient during said uptake period;
11   placing the patient on said patient support;
12   moving said patient support to position the patient within said CT scanner
13 patient gantry such that a selected region to be studied is within a field of view of
14 said CT scanner;
15   acquiring a CT image of the selected region of the patient;
16   reconstructing said CT image to achieve a reconstructed CT image;
17   generating attenuation correction factors from said reconstructed CT image;
18   moving said patient support to position the patient within said PET scanner
19 patient gantry such that the selected region to be studied is within a field of view of
20 said PET scanner;
21   acquiring a PET image of the selected region of the patient;
22   correcting said PET image for scatter to achieve a scatter-corrected PET
23 image; and
24   reconstructing said scatter-corrected PET image to achieve a reconstructed
25 PET image.

1   77.   The method of Claim 76, after said step of acquiring a CT image and
2 before said step of reconstructing said CT image, further comprising the step of
3 correcting said CT image for artifacts due to field of view truncation.

1   78.   The method of Claim 77 wherein said step of correcting said CT image
2   includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image
4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the
6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the
8   selected region using an average linear attenuation coefficient for the truncated
9   portion of the selected region; and

10   adding said volume to said CT image.

1   79.   The method of Claim 76 wherein said step of generating attenuation
2   correction factors from said reconstructed CT image is performed using the steps
3   of:

4   estimating an attenuation image at 511 keV using a threshold to separate
5   out a bone component of said reconstructed CT image; and

6   scaling said bone component using a first scaling factor and a non-bone
7   component of said reconstructed CT image using a second scaling factor.

1   80.   The method of Claim 76 further including the step of displaying at
2   least one of said reconstructed CT image and said reconstructed PET image.

1   81.   The method of Claim 76 further including the step of fusing said
2   reconstructed CT image and said reconstructed PET image to achieve a fused
3   PET/CT image.

1   82.   The method of Claim 76, during said step of acquiring a PET image of
2   the selected region of the patient, further comprising the step of continuously
3   moving said patient support in an axial direction within said patient gantry,
4   whereby normalization effects between individual detector rings of said PET
5   scanner are eliminated.

1   83.   The method of Claim 76 wherein said CT scanner patient gantry is
2   separate from and fixed relative to said PET scanner patient gantry, said patient

3   support being movable between said CT scanner patient gantry and said PET

4   scanner patient gantry, whereby said step of acquiring a CT image of the selected

5   region of the patient is accomplished within said CT scanner patient gantry, and

6   whereby said step of acquiring a PET image of the selected region of the patient is

7   accomplished within said PET scanner patient gantry.

1   84.   The method of Claim 76 wherein said CT scanner patient gantry is

2   separate from said PET scanner patient gantry, wherein at least one of said CT

3   scanner and said PET scanner is movable with respect the other, and wherein said

4   patient support is movable between said CT scanner patient gantry and said PET

5   scanner patient gantry, whereby said step of acquiring a CT image of the selected

6   region of the patient is accomplished within said CT scanner patient gantry, and

7   whereby said step of acquiring a PET image of the selected region of the patient is

8   accomplished within said PET scanner patient gantry.

1   85.   The method of Claim 84 wherein said step of moving said patient

2   support to position the patient within said CT scanner patient gantry is

3   accomplished by moving said CT scanner to receive said patient bed within said CT

4   scanner patient gantry.

1   86.   The method of Claim 84 wherein said step of moving said patient

2   support to position the patient within said PET scanner patient gantry is

3   accomplished by moving said PET scanner to receive said patient bed within said

4   PET scanner patient gantry.

1   87.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   CT scanner having a patient gantry, a PET scanner having a patient gantry, a

4   patient support for supporting a patient positioned within each of said CT scanner

5   patient gantry and said PET scanner patient gantry, and a display device, said

6   method comprising the steps of:

7   introducing a tracer into a patient for detection by said combined PET and

8   X-Ray CT tomograph;

9   waiting for an uptake period to expire, the tracer being circulated through
10   and absorbed by the patient during said uptake period;
11   placing the patient on said patient support;
12   moving said patient support to position the patient within said CT scanner
13   patient gantry such that a selected region to be studied is within a field of view of
14   said CT scanner;
15   acquiring a CT image of the selected region of the patient;
16   reconstructing said CT image to achieve a reconstructed CT image;
17   generating attenuation correction factors from said reconstructed CT image;
18   moving said patient support to position the patient within said PET scanner
19   patient gantry such that the selected region to be studied is within a field of view of
20   said PET scanner;
21   acquiring a PET image of the selected region of the patient;
22   correcting said PET image for scatter to achieve a scatter-corrected PET
23   image;
24   applying said attenuation correction factors to said scatter-corrected PET
25   image to achieve an attenuation-corrected PET image; and
26   reconstructing said attenuation-corrected PET image to achieve a
27   reconstructed PET image.

1   88.   The method of Claim 87, after said step of acquiring a CT image and
2   before said step of reconstructing said CT image, further comprising the step of
3   correcting said CT image for artifacts due to field of view truncation.

1   89.   The method of Claim 88 wherein said step of correcting said CT image
2   includes the steps of:
3   obtaining a non-corrected PET image, said non-corrected PET image
4   reconstructed without attenuation correction;
5   determining a boundary of a truncated portion of the selected region of the
6   patient using said non-corrected PET image;
7   estimating a volume within said boundary of the truncated portion of the
8   selected region using an average linear attenuation coefficient for the truncated
9   portion of the selected region; and

10   adding said volume to said CT image.

1   90.   The method of Claim 87 wherein said step of generating attenuation
2   correction factors from said reconstructed CT image is performed using the steps
3   of:
4   estimating an attenuation image at 511 keV using a threshold to separate
5   out a bone component of said reconstructed CT image; and
6   scaling said bone component using a first scaling factor and a non-bone
7   component of said reconstructed CT image using a second scaling factor.

1   91.   The method of Claim 87 wherein said step of reconstructing said
2   attenuation-corrected PET image is accomplished using a Fourier rebinning
3   technique and then independently by an ordered-subset EM iterative
4   reconstruction algorithm.

1   92.   The method of Claim 87 further including the step of displaying at
2   least one of said reconstructed CT image and said reconstructed PET image.

1   93.   The method of Claim 87 further including the step of fusing said
2   reconstructed CT image and said reconstructed PET image to achieve a fused
3   PET/CT image.

1   94.   The method of Claim 87, during said step of acquiring a PET image of
2   the selected region of the patient, further comprising the step of continuously
3   moving said patient support in an axial direction within said patient gantry,
4   whereby normalization effects between individual detector rings of said PET
5   scanner are eliminated.

1   95.   The method of Claim 87 wherein said CT scanner patient gantry is
2   separate from and fixed relative to said PET scanner patient gantry, said patient
3   support being movable between said CT scanner patient gantry and said PET
4   scanner patient gantry, whereby said step of acquiring a CT image of the selected
5   region of the patient is accomplished within said CT scanner patient gantry, and
6   whereby said step of acquiring a PET image of the selected region of the patient is
7   accomplished within said PET scanner patient gantry.

1   96.   The method of Claim 87 wherein said CT scanner patient gantry is

2   separate from said PET scanner patient gantry, wherein at least one of said CT

3   scanner and said PET scanner is movable with respect the other, and wherein said

4   patient support is movable between said CT scanner patient gantry and said PET

5   scanner patient gantry, whereby said step of acquiring a CT image of the selected

6   region of the patient is accomplished within said CT scanner patient gantry, and

7   whereby said step of acquiring a PET image of the selected region of the patient is

8   accomplished within said PET scanner patient gantry.

1   97.   The method of Claim 96 wherein said step of moving said patient

2   support to position the patient within said CT scanner patient gantry is

3   accomplished by moving said CT scanner to receive said patient bed within said CT

4   scanner patient gantry.

1   98.   The method of Claim 96 wherein said step of moving said patient

2   support to position the patient within said PET scanner patient gantry is

3   accomplished by moving said PET scanner to receive said patient bed within said

4   PET scanner patient gantry.

1   99.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   CT scanner having a patient gantry, a PET scanner having a patient gantry, a

4   patient support for supporting a patient positioned within each of said CT scanner

5   patient gantry and said PET scanner patient gantry, and a display device, said

6   method comprising the steps of:

7   introducing a tracer into a patient for detection by said combined PET and

8   X-Ray CT tomograph;

9   waiting for an uptake period to expire, the tracer being circulated through

10   and absorbed by the patient during said uptake period;

11   placing the patient on said patient support;

12   moving said patient support to position the patient within said CT scanner

13   patient gantry such that a selected region to be studied is within a field of view of

14   said CT scanner;

15   acquiring a CT image of the selected region of the patient;

16   reconstructing said CT image to achieve a reconstructed CT image;

17   generating attenuation correction factors from said reconstructed CT image;

18   moving said patient support to position the patient within said PET scanner

19   patient gantry such that the selected region to be studied is within a field of view of

20   said PET scanner;

21   acquiring a PET image of the selected region of the patient;

22   correcting said PET image for scatter to achieve a scatter-corrected PET

23   image;

24   applying said attenuation correction factors to said scatter-corrected PET

25   image to achieve an attenuation-corrected PET image;

26   reconstructing said attenuation-corrected PET image to achieve a

27   reconstructed PET image;

28   fusing said reconstructed CT image and said reconstructed PET image to

29   achieve a fused PET/CT image; and

30   displaying said fused PET/CT image.

1   100.   The method of Claim 99, after said step of acquiring a CT image and

2   before said step of reconstructing said CT image, further comprising the step of

3   correcting said CT image for artifacts due to field of view truncation.

1   101.   The method of Claim 100 wherein said step of correcting said CT

2   image includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image

4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the

6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the

8   selected region using an average linear attenuation coefficient for the truncated

9   portion of the selected region; and

10   adding said volume to said CT image.

1   102. The method of Claim 99 wherein said step of generating attenuation
2   correction factors from said reconstructed CT image is performed using the steps
3   of:
4   estimating an attenuation image at 511 keV using a threshold to separate
5   out a bone component of said reconstructed CT image; and
6   scaling said bone component using a first scaling factor and a non-bone
7   component of said reconstructed CT image using a second scaling factor.

1   103. The method of Claim 99 wherein said step of reconstructing said
2   attenuation-corrected PET image is accomplished using a Fourier rebinning
3   technique and then independently by an ordered-subset EM iterative
4   reconstruction algorithm.

1   104. The method of Claim 99, during said step of acquiring a PET image of
2   the selected region of the patient, further comprising the step of continuously
3   moving said patient support in an axial direction within said patient gantry,
4   whereby normalization effects between individual detector rings of said PET
5   scanner are eliminated.

1   105. The method of Claim 99 wherein said CT scanner patient gantry is
2   separate from and fixed relative to said PET scanner patient gantry, said patient
3   support being movable between said CT scanner patient gantry and said PET
4   scanner patient gantry, whereby said step of acquiring a CT image of the selected
5   region of the patient is accomplished within said CT scanner patient gantry, and
6   whereby said step of acquiring a PET image of the selected region of the patient is
7   accomplished within said PET scanner patient gantry.

1   106. The method of Claim 99 wherein said CT scanner patient gantry is
2   separate from said PET scanner patient gantry, wherein at least one of said CT
3   scanner and said PET scanner is movable with respect the other, and wherein said
4   patient support is movable between said CT scanner patient gantry and said PET
5   scanner patient gantry, whereby said step of acquiring a CT image of the selected
6   region of the patient is accomplished within said CT scanner patient gantry, and

7   whereby said step of acquiring a PET image of the selected region of the patient is

8   accomplished within said PET scanner patient gantry.

1   107.   The method of Claim 106 wherein said step of moving said patient

2   support to position the patient within said CT scanner patient gantry is

3   accomplished by moving said CT scanner to receive said patient bed within said CT

4   scanner patient gantry.

1   108.   The method of Claim 106 wherein said step of moving said patient

2   support to position the patient within said PET scanner patient gantry is

3   accomplished by moving said PET scanner to receive said patient bed within said

4   PET scanner patient gantry.

1   109.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   patient gantry for use with both a CT scanner and a PET scanner, a patient

4   support for supporting a patient positioned within said patient gantry, and a

5   display device, said method comprising the steps of:

6   introducing a tracer into a patient for detection by said combined PET and

7   X-Ray CT tomograph;

8   waiting for an uptake period to expire, the tracer being circulated through

9   and absorbed by the patient during said uptake period;

10   placing the patient on said patient support;

11   moving said patient support to position the patient within said patient

12   gantry such that a selected region to be studied is within a field of view of said CT

13   scanner;

14   acquiring a CT image of the selected region of the patient;

15   moving said patient support to position the patient within said patient

16   gantry such that the selected region to be studied is within a field of view of said

17   PET scanner;

18   acquiring a PET image of the selected region of the patient; and

19   reconstructing said PET image to achieve a reconstructed PET image.

1   110. The method of Claim 109, during said step of acquiring a PET image

2 of the selected region of the patient, further comprising the step of continuously

3 moving said patient support in an axial direction within said patient gantry,

4 whereby normalization effects between individual detector rings of said PET

5 scanner are eliminated.

1   111. A method for acquiring PET and CT images within a combined PET

2 and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3 patient gantry for use with both a CT scanner and a PET scanner, a patient

4 support for supporting a patient positioned within said patient gantry, and a

5 display device, said method comprising the steps of:

6   introducing a tracer into a patient for detection by said combined PET and

7 X-Ray CT tomograph;

8   waiting for an uptake period to expire, the tracer being circulated through

9 and absorbed by the patient during said uptake period;

10   placing the patient on said patient support;

11   moving said patient support to position the patient within said patient

12 gantry such that a selected region to be studied is within a field of view of said CT

13 scanner;

14   acquiring a CT image of the selected region of the patient;

15   reconstructing said CT image to achieve a reconstructed CT image;

16   moving said patient support to position the patient within said patient

17 gantry such that the selected region to be studied is within a field of view of said

18 PET scanner;

19   acquiring a PET image of the selected region of the patient; and

20   reconstructing said PET image to achieve a reconstructed PET image.

1   112. The method of Claim 111, after said step of acquiring a CT image and

2 before said step of reconstructing said CT image, further comprising the step of

3 correcting said CT image for artifacts due to field of view truncation.

1   113. The method of Claim 112 wherein said step of correcting said CT

2 image includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image

4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the

6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the

8   selected region using an average linear attenuation coefficient for the truncated

9   portion of the selected region; and

10   adding said volume to said CT image.

1   114.   The method of Claim 111 further including the step of displaying at

2   least one of said reconstructed CT image and said reconstructed PET image.

1   115.   The method of Claim 111 further including the step of fusing said

2   reconstructed CT image and said reconstructed PET image to achieve a fused

3   PET/CT image.

1   116.   The method of Claim 111, during said step of acquiring a PET image

2   of the selected region of the patient, further comprising the step of continuously

3   moving said patient support in an axial direction within said patient gantry,

4   whereby normalization effects between individual detector rings of said PET

5   scanner are eliminated.

1   117.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   patient gantry for use with both a CT scanner and a PET scanner, a patient

4   support for supporting a patient positioned within said patient gantry, and a

5   display device, said method comprising the steps of:

6   introducing a tracer into a patient for detection by said combined PET and

7   X-Ray CT tomograph;

8   waiting for an uptake period to expire, the tracer being circulated through

9   and absorbed by the patient during said uptake period;

10   placing the patient on said patient support;

11 moving said patient support to position the patient within said patient
12 gantry such that a selected region to be studied is within a field of view of said CT
13 scanner;
14   acquiring a CT image of the selected region of the patient;
15   reconstructing said CT image to achieve a reconstructed CT image;
16   generating attenuation correction factors from said reconstructed CT image;
17   moving said patient support to position the patient within said patient
18 gantry such that the selected region to be studied is within a field of view of said
19 PET scanner;
20   acquiring a PET image of the selected region of the patient; and
21   reconstructing said PET image to achieve a reconstructed PET image.

1   118.   The method of Claim 117, after said step of acquiring a CT image and
2   before said step of reconstructing said CT image, further comprising the step of
3   correcting said CT image for artifacts due to field of view truncation.

1   119.   The method of Claim 118 wherein said step of correcting said CT
2   image includes the steps of:
3   obtaining a non-corrected PET image, said non-corrected PET image
4   reconstructed without attenuation correction;
5   determining a boundary of a truncated portion of the selected region of the
6   patient using said non-corrected PET image;
7   estimating a volume within said boundary of the truncated portion of the
8   selected region using an average linear attenuation coefficient for the truncated
9   portion of the selected region; and
10   adding said volume to said CT image.

1   120.   The method of Claim 117 wherein said step of generating attenuation
2   correction factors from said reconstructed CT image is performed using the steps
3   of:
4   estimating an attenuation image at 511 keV using a threshold to separate
5   out a bone component of said reconstructed CT image; and
6   scaling said bone component using a first scaling factor and a non-bone
7   component of said reconstructed CT image using a second scaling factor.

1   121.   The method of Claim 117 further including the step of displaying at

2   least one of said reconstructed CT image and said reconstructed PET image.

1   122.   The method of Claim 117 further including the step of fusing said

2   reconstructed CT image and said reconstructed PET image to achieve a fused

3   PET/CT image.

1   123.   The method of Claim 117, during said step of acquiring a PET image

2   of the selected region of the patient, further comprising the step of continuously

3   moving said patient support in an axial direction within said patient gantry,

4   whereby normalization effects between individual detector rings of said PET

5   scanner are eliminated.

1   124.   A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   patient gantry for use with both a CT scanner and a PET scanner, a patient

4   support for supporting a patient positioned within said patient gantry, and a

5   display device, said method comprising the steps of:

6   introducing a tracer into a patient for detection by said combined PET and

7   X-Ray CT tomograph;

8   waiting for an uptake period to expire, the tracer being circulated through

9   and absorbed by the patient during said uptake period;

10   placing the patient on said patient support;

11   moving said patient support to position the patient within said patient

12   gantry such that a selected region to be studied is within a field of view of said CT

13   scanner;

14   acquiring a CT image of the selected region of the patient;

15   reconstructing said CT image to achieve a reconstructed CT image;

16   generating attenuation correction factors from said reconstructed CT image;

17   moving said patient support to position the patient within said patient

18   gantry such that the selected region to be studied is within a field of view of said

19   PET scanner;

20   acquiring a PET image of the selected region of the patient;

21   correcting said PET image for scatter to achieve a scatter-corrected PET

22   image; and

23   reconstructing said scatter-corrected PET image to achieve a reconstructed

24   PET image.

1   125.   The method of Claim 124, after said step of acquiring a CT image and

2   before said step of reconstructing said CT image, further comprising the step of

3   correcting said CT image for artifacts due to field of view truncation.

1   126.   The method of Claim 125 wherein said step of correcting said CT

2   image includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image

4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the

6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the

8   selected region using an average linear attenuation coefficient for the truncated

9   portion of the selected region; and

10   adding said volume to said CT image.

1   127.   The method of Claim 124 wherein said step of generating attenuation

2   correction factors from said reconstructed CT image is performed using the steps

3   of:

4   estimating an attenuation image at 511 keV using a threshold to separate

5   out a bone component of said reconstructed CT image; and

6   scaling said bone component using a first scaling factor and a non-bone

7   component of said reconstructed CT image using a second scaling factor.

1   128.   The method of Claim 124 further including the step of displaying at

2   least one of said reconstructed CT image and said reconstructed PET image.

1   129.   The method of Claim 124 further including the step of fusing said
2   reconstructed CT image and said reconstructed PET image to achieve a fused
3   PET/CT image.

1   130.   The method of Claim 124, during said step of acquiring a PET image
2   of the selected region of the patient, further comprising the step of continuously
3   moving said patient support in an axial direction within said patient gantry,
4   whereby normalization effects between individual detector rings of said PET
5   scanner are eliminated.

1   131.   A method for acquiring PET and CT images within a combined PET
2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a
3   patient gantry for use with both a CT scanner and a PET scanner, a patient
4   support for supporting a patient positioned within said patient gantry, and a
5   display device, said method comprising the steps of:
6   introducing a tracer into a patient for detection by said combined PET and
7   X-Ray CT tomograph;
8   waiting for an uptake period to expire, the tracer being circulated through
9   and absorbed by the patient during said uptake period;
10   placing the patient on said patient support;
11   moving said patient support to position the patient within said patient
12   gantry such that a selected region to be studied is within a field of view of said CT
13   scanner;
14   acquiring a CT image of the selected region of the patient;
15   reconstructing said CT image to achieve a reconstructed CT image;
16   generating attenuation correction factors from said reconstructed CT image;
17   moving said patient support to position the patient within said patient
18   gantry such that the selected region to be studied is within a field of view of said
19   PET scanner;
20   acquiring a PET image of the selected region of the patient;
21   correcting said PET image for scatter to achieve a scatter-corrected PET
22   image;

23   applying said attenuation correction factors to said scatter-corrected PET

24   image to achieve an attenuation-corrected PET image; and

25   reconstructing said attenuation-corrected PET image to achieve a

26   reconstructed PET image.

1   132.   The method of Claim 131, after said step of acquiring a CT image and

2   before said step of reconstructing said CT image, further comprising the step of

3   correcting said CT image for artifacts due to field of view truncation.

1   133.   The method of Claim 132 wherein said step of correcting said CT

2   image includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image

4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the

6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the

8   selected region using an average linear attenuation coefficient for the truncated

9   portion of the selected region; and

10   adding said volume to said CT image.

1   134.   The method of Claim 131 wherein said step of generating attenuation

2   correction factors from said reconstructed CT image is performed using the steps

3   of:

4   estimating an attenuation image at 511 keV using a threshold to separate

5   out a bone component of said reconstructed CT image; and

6   scaling said bone component using a first scaling factor and a non-bone

7   component of said reconstructed CT image using a second scaling factor.

1   135.   The method of Claim 131 wherein said step of reconstructing said

2   attenuation-corrected PET image is accomplished using a Fourier rebinning

3   technique and then independently by an ordered-subset EM iterative

4   reconstruction algorithm.

1   136. The method of Claim 131 further including the step of displaying at

2   least one of said reconstructed CT image and said reconstructed PET image.

1   137. The method of Claim 131 further including the step of fusing said

2   reconstructed CT image and said reconstructed PET image to achieve a fused

3   PET/CT image.

1   138. The method of Claim 137, during said step of acquiring a PET image

2   of the selected region of the patient, further comprising the step of continuously

3   moving said patient support in an axial direction within said patient gantry,

4   whereby normalization effects between individual detector rings of said PET

5   scanner are eliminated.

1   139. A method for acquiring PET and CT images within a combined PET

2   and X-Ray CT tomograph, the combined PET and X-Ray CT tomograph including a

3   patient gantry for use with both a CT scanner and a PET scanner, a patient

4   support for supporting a patient positioned within said patient gantry, and a

5   display device, said method comprising the steps of:

6   introducing a tracer into a patient for detection by said combined PET and

7   X-Ray CT tomograph;

8   waiting for an uptake period to expire, the tracer being circulated through

9   and absorbed by the patient during said uptake period;

10   placing the patient on said patient support;

11   moving said patient support to position the patient within said patient

12   gantry such that a selected region to be studied is within a field of view of said CT

13   scanner;

14   acquiring a CT image of the selected region of the patient;

15   reconstructing said CT image to achieve a reconstructed CT image;

16   generating attenuation correction factors from said reconstructed CT image;

17   moving said patient support to position the patient within said patient

18 gantry such that the selected region to be studied is within a field of view of said

19 PET scanner;

20   acquiring a PET image of the selected region of the patient;

21   correcting said PET image for scatter to achieve a scatter-corrected PET

22 image;

23   applying said attenuation correction factors to said scatter-corrected PET

24 image to achieve an attenuation-corrected PET image;

25   reconstructing said attenuation-corrected PET image to achieve a

26 reconstructed PET image;

27   fusing said reconstructed CT image and said reconstructed PET image to

28 achieve a fused PET/CT image; and

29   displaying said fused PET/CT image.

1   140.   The method of Claim 139, after said step of acquiring a CT image and

2   before said step of reconstructing said CT image, further comprising the step of

3   correcting said CT image for artifacts due to field of view truncation.

1   141.   The method of Claim 140 wherein said step of correcting said CT

2   image includes the steps of:

3   obtaining a non-corrected PET image, said non-corrected PET image

4   reconstructed without attenuation correction;

5   determining a boundary of a truncated portion of the selected region of the

6   patient using said non-corrected PET image;

7   estimating a volume within said boundary of the truncated portion of the

8   selected region using an average linear attenuation coefficient for the truncated

9   portion of the selected region; and

10   adding said volume to said CT image.

1   142.   The method of Claim 139 wherein said step of generating attenuation

2   correction factors from said reconstructed CT image is performed using the steps

3   of:

4   estimating an attenuation image at 511 keV using a threshold to separate

5   out a bone component of said reconstructed CT image; and

6   scaling said bone component using a first scaling factor and a non-bone

7   component of said reconstructed CT image using a second scaling factor.

1   143.   The method of Claim 139 wherein said step of reconstructing said

2   attenuation-corrected PET image is accomplished using a Fourier rebinning

3   technique and then independently by an ordered-subset EM iterative

4   reconstruction algorithm.

1   144.   The method of Claim 139, during said step of acquiring a PET image

2   of the selected region of the patient, further comprising the step of continuously

3   moving said patient support in an axial direction within said patient gantry,

4   whereby normalization effects between individual detector rings of said PET

5   scanner are eliminated.

1   145.   A method for acquiring at least a PET image within a PET tomograph

2   including at least a PET scanner disposed within a patient gantry, a patient

3   support for supporting a patient positioned within said patient gantry, and a

4   display device, said method comprising the steps of:

5   introducing a tracer into a patient for detection by said PET tomograph;

6   waiting for an uptake period to expire, the tracer being circulated through

7   and absorbed by the patient during said uptake period;

8   placing the patient on said patient support;

9   moving said patient support to position the patient within said patient

10   gantry such that a selected region to be studied is within a field of view of said PET

11   scanner;

12   acquiring a PET image of the selected region of the patient;

13   continuously moving said patient support in an axial direction within said

14   patient gantry during said step of acquiring a PET image, whereby normalization

15   effects between individual detector rings of said PET scanner are eliminated;

16   correcting said PET image for scatter to achieve a scatter-corrected PET

17   image;

18   applying attenuation correction factors to said scatter-corrected PET image

19   to achieve an attenuation-corrected PET image; and

20   reconstructing said attenuation-corrected PET image to achieve a
21 reconstructed PET image.